

Standards for Microfilming Records

Introduction

Micrographics is the term used to describe the techniques associated with the production, handling, and use of microfilm. Properly produced microfilm is a valuable tool in any records program. Microfilm can assist in reducing storage costs, increasing the protection of vital information, and creating a more durable medium for reference use as a substitute for the original documents.

This leaflet identifies the national standards and guidelines to be used in the production and storage of high-quality microfilm. Film that meets these standards and guidelines should be the goal of every microfilming project, whether the film is produced by a service bureau or by an in-house micrographics program.

All standards and guidelines in this leaflet are based on American National Standards Institute (ANSI) and Association for Information and Image Management (AIIM) standards and are endorsed by the Georgia Archives. The Georgia Archives recommends that all agency micrographics program managers familiarize themselves with ANSI/AIIM MS23-1998, *Practice for Operational Procedures/Inspection and Quality Control of First Generation, Silver-Gelatin Microfilm of Documents*, which provides additional information on many of the topics covered in this leaflet.

Laws and Regulations

The state of Georgia has several legal requirements for microfilm. The laws and regulations that govern microfilming in Georgia are set out in the Georgia Records Act (O.C.G.A. §50-18-90 *et seq.*). This leaflet carries out the requirements of O.C.G.A. §50-18-120 with regard to the establishment of micrographics standards for the production of high quality film. It updates 1987 Georgia Archives standards regarding the use of microfilm for the storage of public records. This leaflet does not cover technical standards relating to the production of Computer Output Microfilm (COM) or the production of preservation quality microfilm.

While the Georgia Archives Records and Information Management Services office can provide advice on records retention and micrographics applications, the responsibility for meeting all legal requirements rests with each individual public official for the records of his or her office.

Legal Requirements

When microfilm is to serve as or in place of the original record, the following requirements must be met:

- All microfilm must meet all the requirements set out in this leaflet.
- Microfilm images must contain all the recorded information shown on the original documents, free of obstructions, shadows, or glare which may impair the legibility of the documents.
- Only silver-gelatin film with a polyester film base may be used to replace original records that have a retention period of twenty years or more.
- When the original paper document is replaced with microfilm, the master negative film can be used only to produce a second generation silver copy for use as a duplicating master. Once the second generation copy is produced, the master negative should be placed in an off-site storage facility that meets the standards set out in this leaflet.
- The records custodian must certify that the film is complete and accurate.

- All microfilm must be inspected using the guidelines specified in this leaflet.
- The records custodian must document adherence to guidelines and standards specified in the Georgia Archives publication, "Archives Advice No.16 Recordkeeping Requirements for Your Micrographics Program."

Destruction of Original Records

If the microfilm produced meets all the legal requirements set out above, the original document may be destroyed in accordance with the January 18, 1996 Resolution of the State Records Committee.

Selection of Records to Film

The first step in any micrographics project is the selection of records for filming. Public officials should consult retention schedules when determining which records are suited for reformatting on microfilm. As a general rule, records that must be available for agency use for twenty years or more are most suited for microfilm. Physical condition and reference rates may also be determining factors in the decision to microfilm records.

Document Preparation/Camera-Ready Preparation

Preparing documents to be filmed begins with arrangement--both intellectual and physical--of the material itself in order to make it accessible to future readers. Document preparation is the responsibility of the agency whose records are being filmed. If a commercial vendor prepares the documents for filming, strict instructions regarding the order should be provided as part of the service contract. Preparation work includes, but is not limited to, the following:

- Unfolding and flattening documents.
- Weeding or flagging duplicates and other material that should not be filmed.
- Removing fasteners and attachments.
- Removing the binding for items with very tight gutter margins.
- Removing surface dirt, mold, tape, and other blemishes that obscure the informational content of documents.*
- Repairing or enclosing in polyester sleeves items that would otherwise be too fragile or fragmented for filming.*
- Estimating the number of images that will fit on a roll of film and determining reel breaks.
- Creating and inserting targets to convey information to the film user (discussed below).
- Listing special instructions to assist the camera operator during filming.

Arrange and film the records in the order in which they were created. Misplaced sheets, pages, folders or other file units should be put in the correct order. The goal of making the documents camera-ready is to enable the camera operator to "turn and shoot."

*For additional information in the current techniques for dirt, mold and tape removal as well as basic repair techniques, contact the Georgia Archives at (678) 364-3761.

Targeting

Targets are visual indicators placed throughout a roll of film. Targets present users with certain information about the original documents and about the technical details of the microfilm itself. Targets should be included on every roll produced.

Include the following targets at the beginning of the roll of microfilm:

- **Start Target:** This target has the word **START** printed in large, eye-legible letters, clearly indicating the beginning of the film.
- **Roll Number Target:** This target identifies the roll.
- **Density Target:** This target is a sheet of paper or card stock free of lines and creases which is the exact size and close to the color of the documents being filmed. It is common practice to use an 8 ½ by 11-inch sheet of white paper when several different colors of documents are being filmed. The density reading taken from this target must conform to ANSI/AIIM standards. See the section on Quality Standards for Filming in this leaflet for more information on density.
- **Declaration by Camera Operator Target:** This target identifies the government agency producing the film, the location of the agency, the reduction ratio for the roll, and the date of filming.
- **Certification of Authenticity Target:** This target states that the records contained on the roll are accurate and complete copies of the original records. A signature of the appropriate authority (the public official responsible for the records) should be included. This target is necessary for legal verification.
- **Resolution Testing /Technical Target:** This testing target is essential to measure the quality of the film. It is made up of five test charts on one sheet of paper. Prepared resolution targets are available from suppliers or AIIM. Do not use photocopies of resolution targets.
- **Title Target:** This target identifies the agency, the records being filmed, and the inclusive dates of the records.
- **Specific Series/File Identification/Page (title of book or file) Target:** This target identifies the specific file, volume, or date span that is filmed. In the case of personnel files, an example would be the "File of Jones, John."
- **Documents Target:** The actual documents are filmed in sequence followed by a blank frame called a flash space, or a blank sheet of paper and a new specific series target for each new file or volume filmed.

When the roll is complete, include the following targets at the end of the roll of microfilm:

- **Repeat of Title Page Target**
- **Repeat of Certification of Authenticity Target**
- **Repeat of Resolution Testing/Technical Target**
- **Repeat of Density Target**
- **Repeat of Roll Number Target (included in case the leader is lost)**
- **End/Please Rewind Target:** This target should have the word **END** printed in large letters to indicate the end of the roll.

The Georgia Archives Records and Information Management Services can supply sample targets, if needed. Technical targets may be purchased from AIIM International. The technical targets are used to determine whether each roll meets quality standards and the results written on each box/container. If the results of the tests are not within ANSI standards, the entire microfilm roll must be refiled. For more information on technical targets, see ANSI/AIIM MS19-1993 *Recommended Practice – Identification of Microforms* and ANSI/NISO Z39.62-2000 *Eye-Legible Information on Microfilm Leaders and Trailers and on Containers of Processed Microfilm on Open Reels*.

Selection of Equipment and Supplies

Selecting the proper equipment is a decision based on the characteristics of the records to be filmed. For more information regarding the selection of equipment and supplies, refer to ANSI/AIIM MS23-1998 *Practice for Operational Procedures/Inspection and Quality Control of First Generation, Silver-Gelatin Microfilm of Documents*.

Equipment

Each camera used should be capable of producing a clear, sharp, photographic film copy of all documents, with the master negative meeting the appropriate standards. If the camera has time and date capabilities, the camera should use four-digit year dates.

Planetary cameras offer maximum flexibility in image arrangement (format), reduction ratios, and exposure settings. They are traditionally preferred for microfilming records that are old and in poor condition or have a permanent retention.

Technological advances in rotary cameras have made them more useful in recent years. Rotary cameras are ideal in situations where standardized paper size, composition, ink colors, and the use of forms exist. Very old, brittle, or damaged records or records with a mix of document characteristics (size, color, and weight) should be filmed with planetary, not rotary, cameras.

Before microfilming, inspect and calibrate cameras according to the manufacturer's specifications and unique requirements. Inspect the lens and other camera parts (counters, exposure controls, lights, etc.) daily to ensure that the equipment is operating and calibrated properly. As a further precaution, clean and check working parts when changing rolls of film. To ensure an acceptable quality product, conduct periodic resolution tests using standard processed film strips.

For more information on cameras, refer to ANSI/AIIM MS26-1990 (A1999), *35mm Planetary Cameras (Top Light)- Procedures for Determining Illumination Uniformity of Microfilming Engineering Drawings* and ANSI/AIIM MS47-1994, *Rotary Cameras for 16mm Microfilm - Mechanical and Optical Characteristics*.

Filming Area

In the filming area, install dividers between cameras to prevent stray light that may affect exposure. Use a voltage stabilizer to maintain constant illumination during microfilming and duplication. Keep the area free from dust, food, smoke, and other contaminants. Restrict the camera area from general admittance and use.

Film Format

There are two basic formats: roll film and sheet film. Roll film comes in three sizes – 35mm, 16mm and 105mm. Sheet film can be microfiche that is made from precut sheets or 105mm rolls or microfilm jackets. For each format, standards exist to ensure the film's stability for its life expectancy. Preservation

microfilming is usually done on 35mm roll film because it provides better image quality and legibility. In roll format, microfilm should be in lengths of 100 feet.

For more information on standards governing roll film, see ANSI/AIIM MS14-1996, *Specifications for 16mm and 35mm Roll Microfilm* and ANSI/AIIM MS34-1990, *Dimensions of Reels Used with Processed 16mm and 35mm Microfilm not for Use in Automatic Threading Equipment*. For microfiche and microfilm jackets, use the following standard: ANSI/AIIM MS5-1992 (R1998), *Micrographic Microfiche*.

Film Size

The choice of microfilm size depends primarily on the size, tonal contrast, and fineness of detail of the documents to be filmed. For example, it would be inappropriate to microfilm engineering drawings or plat books on a 16mm reel of film, because the reduction ratio required would be too great to provide satisfactory reproduction or good legibility of the documents. It is necessary to match the quality of the original documents both to the type of film and the reproduction equipment. Oversized documents are generally produced on 35mm film. 35mm microfilm allows for a relatively large image at a low reduction ratio and can accommodate a greater range of document sizes.

Film Stock and Life Expectancy

The Georgia Archives requires the use of silver gelatin polyester safety film with a life expectancy rating of 500 years (LE-500) for any records with a retention of twenty years or longer. Do not use film that has passed the manufacturer's expiration date.

Use diazo and vesicular films for the creation of reference or use copies. Such copies are produced from the duplicating master for reference or other daily use.

The life expectancy (LE) rating of film is the length of time the microfilm can be expected to survive under proper storage conditions. There are three life expectancy ratings for film: LE-10, LE-100, and LE-500. The LE-10 and LE-100 ratings may be used for estimating the life span of a duplicating master. The rating must be LE-500 for the master negative that will be stored in a monitored media vault designed for microfilm. This rating should be specified on all contracts, purchasing specifications, and other documents pertaining to a microfilming project. Diazo and vesicular films, used for reference, must have at least a LE-10 rating, although LE-100 is preferred.

For more information on the technical standards associated with the LE rating, film stock, and storage see: ANSI/AIIM MS48-1999, *Recommended Practice for Microfilming Public Records on Silver Halide Film* ANSI/NAPM IT9.1-1996 *Imaging Materials – Processed Silver-Gelatin Type Black and White Film - Specifications for Stability (same as ANSI/ISO 10602-1995)*, ANSI/PIMA IT9.2-1998 *Imaging Media-Photographic Processed Films, Plates, and Papers-Filing Enclosures and Storage Containers*, ANSI/NAPM IT9.6-1991 (R1996) *Specifications for Safety Photographic Film (same as ANSI/ISO 535-1990 R1995)*, ANSI/NAPM IT9.8-1994 *Imaging Materials – Photographic Film, Determination of Folding Endurance*, ANSI/NAPM IT9.10-1996 *Imaging Materials – Photographic Film and Paper – Determination of Curl*, ANSI/NAPM IT9.11-1993 *Imaging Media-Processed Safety Photographic Films-Storage*, and ANSI IT9.5-1992 *Imaging Media (Film)-Ammonia-Processed Diazo Films-Specification for Stability*.

Reels, Sleeves and Containers

Microfilm in roll form is wound around a reel. The reel and the container in which the roll will be placed are of crucial importance. The correct reel and container are an inherent part of a good storage. Both reels and containers are available in several materials. Sleeves and jackets used to store sheet film (microfiche) and cut segments of roll film should be made of materials that will not scratch or damage the film. All materials used to enclose film should be free of acids and peroxides that may be released over time and

cause degradation to the image or film stock. Where greater protection is desirable, sealed airtight containers may be used to protect the film from dust and from the damaging effects of relative humidity and airborne impurities.

Do not wind film too tightly on the core. When film is wound too tightly, the risk of scratching increases. When it is wound closer than ¼ inch to the outer edge of the core, it can slip off. Do not attach adhesive labels to the film; do not write on the film with ink, crayon, or pen; nor, use rubber bands to hold the film in place.

For more information on standards governing roll film, see ANSI/PIMA IT9.2-1998 *Imaging Media-Photographic Processed Films, Plates, and Papers-Filing Enclosures and Storage Containers*, ANSI/AIIM MS14-1988 (R1996), *Specifications for 16mm and 35mm Roll Microfilm*, ANSI/AIIM MS29-1992 *Cores and Spools for Recording Equipment – Dimensions*, and ANSI/AIIM MS34-1990, *Dimensions of Reels Used with Processed 16mm and 35mm Microfilm not for Use in Automatic Threading Equipment*. For microfiche and microfilm jackets, use the following standard: ANSI/AIIM MS5-1992 (R1998), *Micrographic Microfiche*, ANSI/AIIM TR11-1987 (A1992) (R1999) (With 1993 Addendum) *Microfilm Jacket Formatting and Loading Techniques*, and ANSI/AIIM MS11-1987 (R1993) (R1999) *Microfilm Jackets*.

Quality Standards for Microfilm

Filming Procedures

Appropriate identification and certification targets should be microfilmed at the beginning and end of each roll. If information is recorded on both sides of a document, both sides should be filmed. Oversized documents should be filmed in sections from left to right and from top to bottom with an overlap of one inch allowed between adjacent sections.

If inconsistently sized materials are filmed, the camera operator may limit the frequency with which the camera mask is adjusted to compensate for the various sizes. While the use of this technique can assist in focusing the reader's attention on the image rather than empty space within a single frame, it adds significantly to the amount of time required to produce a roll of film.

If documents must be filmed out of sequence, insert appropriate information targets. Camera filters should not be used in microfilming documents unless there is insufficient contrast in the documents for normal filming techniques to be successful.

For more information on the standards for filming, see ANSI/AIIM MS23-1998 *Practice for Operational Procedures/Inspection and Quality Control of First Generation, Silver-Gelatin Microfilm of Documents*, ANSI/AIIM MS48-1999 *Recommended Practice for Microfilming Public Records on Silver Halide Film*, and ANSI/AIIM MS111-1994 *Recommended Practice for Microfilming Printed Newspapers on 35mm Roll Microfilm*.

Reduction Ratio

The reduction ratio at which microfilm is produced affects the resolution (discussed below) of the film and that of subsequent generations. While a higher reduction ratio increases the number of images per roll of film, it also increases the difficulty in reading the images. The desired reduction ratio is 10x-16x. Adjustment for oversized documents is permitted up to 21x. Microfiche and 16mm film allow for the use of reduction ratios twice as high as that of 35mm film. The capabilities of the camera largely determine whether higher reduction will reduce legibility.

Image Placement

There are two ways to orient images on film. One position is known as cine mode because the images appear on the microfilm in a way similar to frames on motion picture film. This position is also called

vertical or portrait. The second position is known as comic mode, also called horizontal or landscape. It is similar to the frames in a comic strip. While either arrangement may be used, never mix the two orientations on the same roll of film. Wind the film on the roll so that it is readable from left to right. For additional information, see ANSI/AIIM MS14 1988 (R1996), *Specifications for 16mm and 35mm Roll Microfilm*.

Quality Standards for Processing

The master negative is processed, tested, and edited frame-by-frame prior to being duplicated.

Processing

Process the master negative according to ANSI/AIIM standards. Chemicals used in processing must be compatible with the specific film and processor being used. Chemical preparation must ensure the consistency of photographic densities. Processing procedures must ensure the removal of residual thiosulfate and excess silver salts. Water quality and temperature must be maintained to consistently meet standards. Conduct methylene blue test or iodine-amylose test at least after every eight- (8) hours of processing time or on each individual job. The residual content of the processed microfilm must have a concentration of greater than zero but less than 1.40 milligrams, as established by ANSI/NAPM IT9.1-1996 *Imaging Materials – Processed Silver-Gelatin type Black and White Film - Specification for Stability (same as ANSI/ISO 10602-1995)*.

Density

Density is the measure of film opacity or degree of gray. Measurements are taken to determine film contrast. If the image is too light or too dark, the film cannot be properly duplicated. On the master negative, the maximum density (Dmax)--or background density-- is the dark part of the image, and the minimum density (Dmin), or base fog, is the clear part of the film on which there is no image.

Gross background density (Dmax) will be between 0.80 and 1.30, depending on the kind and color of documents being filmed. For high-contrast records, background density must be between 1.10 and 1.30. Dmax should not vary by more than 0.20 within a reel. Base fog density (Dmin) should be 0.10 or less on all microforms. A properly calibrated densitometer is used to measure density. A calibrated step tablet is used to calibrate a densitometer.

When filming poor quality original documents (i.e., low contrast between text and background), legibility must often be considered in tandem with background density, since density alone is not a guarantee of readability. Generally, low contrast documents should be filmed at a lower exposure setting than high contrast documents. A lower exposure setting will result in a lower density reading.

Check the density on each master negative near the beginning, at one-third into the roll, two-thirds into the roll, and near the end.

Resolution

Resolution is the ability of a film to reproduce fine details sharply. Resolution for the master negative produced on a planetary camera must be no less than 120 lines per millimeter, while that for a rotary camera must be a minimum of eighty-six lines per millimeter. Resolution is measured by using a microscope with a minimum resolving power of 100x and viewing the resolution target (discussed above) to determine the number of visible line pairs.

Quality Index System

The same target used to measure resolution is also used in determining the Quality Index (QI) of the film. Quality Index is a method of relating the type size of printed material to be filmed to the resolving power of the camera in order to ensure the highest possible level of legibility over the desired three generations of film. The QI is used by camera operators to determine how low the reduction must go to adequately capture the smallest letter “e” in the document. There are three levels of quality that can be established using the QI system, high, medium, and marginal.

- High – a QI of 8.0 or more is considered to be excellent quality.
- Medium – a QI of 5.0 is considered acceptable since all alphanumeric characters can be read without difficulty on a first generation master negative.
- Marginal – a QI of 3.0 or lower is unacceptable.

A QI of 3.6 is the required minimum level of legibility. The following formula is used to measure the QI:

$$P = \frac{Q}{H}$$

Where, P = the pattern number (from the resolution target) which must be resolved; Q = the quality desired (marginal, medium, high), and H = the height in millimeters of the pertinent letter or number (lower case “e”) in the document being filmed.

Refer to ANSI/AIIM MS23-1998 *Practice for Operational Procedures/Inspection and Quality Control of First-generation, Silver Microfilm of Documents* for a detailed explanation of the Quality Index System.

Quality Control Inspection

Review processed film to identify processing and filming defects and to ensure that the film meets established standards for resolution, density, and residual chemical levels.

Residual thiosulfate ion testing is conducted by the iodine-amylose or methylene blue method. Take film samples for the test from an area of minimum density (unexposed but processed film), and complete the test within two weeks of processing the film. The maximum allowable concentration of residual thiosulfate is 1.30 milligrams per square centimeter of film. The laboratory should carry out testing with sufficient frequency to ensure consistent quality in processing and duplicating operations, and when any change is made in film, chemicals, or processing procedures.

Inspect film to identify flaws such as shortened images, double exposure, fogging, spotting, fingerprints, frilling, mottling, streaking, and water spots. Inspectors should also be alert for camera malfunctions that cause overlapping, folding, stretching, and other film advance synchronization problems. Defects are classified as major or minor:

- Obliterated or unreadable vital information is considered to be major, and should be immediately brought to the attention of the camera operator.
- All divergences from the established standards should be recorded on a microfilm data collection form that is kept with the film.

Wind the silver processed film (master negative) on plastic reels that are chemically inert and store in plastic airtight containers. Ask your film supplier to provide documentation regarding the original packaging to determine if it may be reused for processed film. All silver master negatives should be free from scratches and other defects.

All processed film should be inspected to determine that its quality is sufficient to produce a legible film or paper copy. If contracting with a vendor, the vendor should ensure the legibility of the film copy and should maintain records of inspection, making these records available upon request by the agency.

Refilming Defective Frames - Retakes

When frames on a roll of processed camera film (master negative) are rejected as not meeting standards or when missing material is subsequently located then the new documents or rejected frames should be refilmed. All filming errors should be corrected on the master negative before duplication.

Retake Targeting

Group the documents in proper sequence and refilm with the following targets:

- Start of Retakes Roll No. ____ Target
- Density Target
- Resolution Testing/Technical Target
- Two Blanks
- Retake Order Target

Film records here.

- Retake Order Target
- Two Blanks

Repeat this sequence for each additional retake.

- End of Retakes for Roll No. ____ Target

The length of the retake film spliced in sequence should be no shorter than six inches. Refilming should include at least two frames preceding and succeeding the frames requiring refilming. If information is recorded on both sides of the document, and the image on either side of the document is unsatisfactory; both sides of the document should be refilmed.

Splicing

Normally, retakes are spliced at the beginning of the master negative roll of film, before the start target but after the two-foot leader. Sometime, it may be preferable to splice new material into its proper sequence on the roll. Retakes should be spliced in correct sequence on the master negative only, and before the duplicating master and reference copies are created. Individual rolls containing refilmed items only are not permitted.

No more than three splices or six cuts are allowed on any single roll of film. If more than three splices are necessary, the entire roll must be refilmed. Splices should only consist of ultrasonic splices. Under no circumstances should different types of film be spliced together on the same roll.

For more information, refer to ANSI/AIIM MS18-1992 (R1998), *Splices for Imaged Microfilm-Dimensions and Operational Constraints* and ANSI/AIIM MS23-1998, previously mentioned. For information regarding the legal expungement of information from microfilm, see ANSI/AIIM MS42-1989

Recommended Practice for the Expungement, Deletion, Correction or Amendment of Records on Microforms.

Duplication/Generations

After all inspections are completed and any retakes are spliced onto the master negative, the master negative will be used to make a silver duplicate negative (duplicating master). This duplicate will be used to make all reference copies of the microfilm. Two types of film may be used for producing the duplicating master, intermediate direct duplicating low contrast film or direct duplicating medium contrast film. Using the low contrast film, the background density should be above 1.10 and the Dmin between 0.15 and 0.25. Using the medium contrast film, the background density should be above 1.40 and the Dmin between 0.10 and 0.20.

All reference copies of processed film should be free from scratches and other defects that prevent legible paper copies from being produced by currently available commercial processes. For more information on standards for duplicating film, see ANSI/AIIM MS46-1990 (A1996) (with 1996 Addendum) *Test Target and Test Method for Determining Output of 35mm Microfilm Duplicators*.

A microfilming program should generate three film copies:

- The silver-gelatin film actually used in the camera is called the master negative, camera master, or first-generation film. The master negative should be used only once; to generate the silver duplicate negative (duplicating master), and thereafter should be kept in extended-term storage conditions as a permanent security copy. The master negative should be wound so that the emulsion (dull, flat side) faces out, away from the center of the reel.
- The silver duplicate negative on silver-gelatin film is called the duplicating master, copy negative or second-generation film. All subsequent reference copies should be produced using the duplicating master. The duplicating master should be wound so that the emulsion side faces inward toward the center of the reel.
- The use copy on diazo or vesicular film is called the reference copy or third generation film. This copy is for use by agency staff and the public. The reference copy should be wound so that the emulsion side faces out, away from the center of the reel.

For more information see, ANSI/AIIM MS48-1990 *Recommended Practice for Microfilming Public Records on Silver Halide Film*, ANSI/NAPM IT9.1-1996 *Imaging Media (Film)-Silver-Gelatin Specifications for Stability (same as ANSI/ISO 10602-1995)*, ANSI/PIMA IT9.2-1998 *Imaging Media-Processed Safety Photographic films-Storage*, and ANSI IT9.5-1992 *Imaging Media (Film)-Ammonia-Processed Diazo Films-Specifications for Stability*.

Film Storage

One of the more important factors in the preservation of microfilm is the storage of the master negative. Unfortunately, many government agencies give this issue little or no thought. No matter how carefully film is selected and produced, it can be damaged severely if it is improperly stored.

The Georgia Archives operates a microfilm storage vault for use by government agencies to store master negative film in an off-site security facility monitored for proper environmental conditions.

Storage Cabinets

Microfilm, once in a container (refer to Reels, Sleeves, and Containers), can be stored on shelves, racks, or in storage cabinets. The use of closed housings, such as drawers or boxes, provides further protection against dust and light. Use shelves or cabinets made from non-corroding and non-combustible material. Powder-coated metal shelving is highly recommended. Special cabinets for microfilm are available

commercially. Do not store film on, or in the same room as, shelves made of wood, pressboard, or particleboard. These materials may release gaseous impurities over time and cause degradation to the film.

For more information on the technical standards for the storage of microfilm, see ANSI/PIMA IT9.2-1998 *Imaging Media-Photographic Processed Films, Plates, and Papers-Filing Enclosures and Storage Containers* and ANSI/NAPM IT9.11-1993 *Imaging Media-Processed Safety Photographic Films-Storage*.

Storage Area

Any room used for the storage of microfilm should be secure and isolated from offices, work areas, or other storage areas. The area should have an independent ventilation system to keep the air as free as possible of pollutants and dust and to prevent the entry of unfiltered air from other parts of the building. If the room is to be painted, use acrylic latex paint and wait at least two weeks after painting before moving microfilm into it.

Ideally, air in the storage area should be filtered to remove gaseous impurities such as sulfur dioxide, hydrogen sulfide, ammonia, peroxides, ozone, nitrogen oxide, and solid particles like dust. The temperature and relative humidity must be rigidly controlled and monitored.

Do not store the silver gelatin master negative or duplicating master with other forms of records. Paper and diazo or vesicular films (reference copies) release impurities that may damage silver gelatin film.

For more information on the technical standards for the storage of microfilm, see ANSI/PIMA IT9.2-1998 *Imaging Media-Photographic Processed Films, Plates, and Papers-Filing Enclosures and Storage Containers* and ANSI/NAPM IT9.11-1993 *Imaging Media-Processed Safety Photographic Films-Storage*.

Fire Protection

Ideally, the fire suppression system installed in the storage area should use dry chemicals, water vapor, CO₂, or foam to extinguish a fire. If microfilm is stored in a fireproof safe or vault, use one that is designed for microfilm or computer media. Safes designed for paper records may not provide enough protection for your film because paper can withstand higher temperatures than microfilm. A safe for microfilm should maintain an internal temperature of 150° or less when it is subjected to fire and it should have a fire-resistant rating of at least four hours.

Humidity

The relative humidity level in the microfilm storage area must be rigidly controlled. It should not exceed 40 percent and, ideally, should be kept within a range of 35 to 40 percent to protect polyester film base (safety film).

The relative humidity level must be kept as constant as possible and should not allow variations to exceed 5 percent in a 24-hour period. Extreme swings in the level of relative humidity will harm your microfilm.

When the relative humidity is below the minimum level, the film may become brittle and the emulsion may dry out and crack or peel. When relative humidity is too high, the emulsion will absorb moisture; the emulsion may then expand and distort the image, or the emulsion surfaces may stick together. When relative humidity is too high, mold may grow on the film and oxidation reduction (redox) blemishes are likely to form.

Temperature

Microfilm should be stored at a constant temperature of less than 68°F, ideally at about 65°F. The temperature, like the relative humidity, should not fluctuate widely. Fluctuations should not exceed 5

percent in a 24-hour period. High temperatures can shrink and buckle the film base, thereby distorting the image. Low temperatures will make the film brittle.

Monitoring Conditions

Once a storage area is set up, monitor it for standards compliance. Install fire alarms. Dataloggers or hygrothermographs will track and record levels of temperature and relative humidity to verify that they remain constant and within proscribed limits. If the facility is in an area prone to flooding, place water detectors on the floor. Purchase a back-up generator to ensure the continuity of electrical systems in the event of a power outage.

Inspect a random sample of stored microfilm on a systematic basis – it is preferred that at least a 1 to 2 percent sample be inspected every two years. If problems are found within the sample, inspect additional rolls to gauge the extent of the damage. Look for signs of deterioration like discoloration, blemishes, evidence of oxidation reduction, fogging, fungus, buckling, brittleness, faded images, and adhesion. Make necessary changes to storage conditions to address environmentally related problems. Copy degraded film onto new silver gelatin film.

Always wear gloves when inspecting film and only inspect security film on supply and take-up reels attached to rewinds. Do not run the film through a reader.

If monitored and stored properly, the master negative should have a life expectancy of 500 years. The master negative would be pulled from the vault for one of the following two reasons:

1. The retention period of the records has expired and all copies of the records are destroyed.
2. A new duplicating master is needed.

For more information on the storage of microforms, see ANSI/AIIM MS45-1990 *Recommended Practice for Inspection of Stored Silver Gelatin Microforms for Evidence of Deterioration* and ANSI/AIIM TR13-1998 *Preservation of Microforms in an Active Environment-Guidelines*.

If you need further assistance, please call the Georgia Archives at (678) 364-3795.